1:00pm, Friday, Nov. 14

Bldg 50 Auditorium

The Bianchi Identities in Regge Calculus

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The Bianchi Identities ensure the divergencelessness of the field side of Einstein's equations, as is required by the divergencelessness of the stress-energy tensor side of the equations. Regge calculus, which breaks up space-time into 4-simplices (or d-simplices in d-space), will be used, eventually, to approximate gravity in numerical simulations. An understanding of how to write the Bianchi Identities in Regge Calculus variables provides deeper insight into Regge Calculus, and hence is the topic of this talk. These results are exact and for arbitrary curvatures, i.e. for arbitrary deficit angles.

Bldg 70 Room 191

McMillan's One-way System, General Passive Unilateral System and Thermodynamics

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E.M.McMillan(1946) showed that by combining a nonreciprocal system, a series connection of an electrostatic and electrodynamic transducers, and a reciprocal sysstem consisting of a resistance we can build a passive one-way system. His system is uniilateral at some discrete frequencies. By using the network synthesis we can build the passive linear system unilaterel over the entire frequency range. (Gamo 1954) If signal goes from 1 to 2 but not from 2 to 1, on the surface it could violate the principles of therrmodynamics. From the condition of passivity, the system must have resistive component. The thermal noise from 2 will be absorbed by the resistive component and the thermal noise generated by the resistive component will go to 1. The system is unilateral for the signal but bilateral for the flow of thermal energy.

1:20pm, Friday, Nov. 14

Bldg 50 Auditorium

The Fall of Stringy de Sitter

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Kachru, Kallosh, Linde, & Trivedi recently constructed a four-dimensional de Sitter compactification of IIB string theory, which they showed to be metastable in agreement with general arguments about de Sitter spacetimes in quantum gravity. In this talk, I will describe how discrete flux choices lead to a closely-spaced set of vacua, known as a discretuum, and explore various decay channels. We find that in many situations NS5-brane meditated decay which exchange NSNS 3-form flux for D3-branes is very fast compared with decompactification decay.

Bldg 70 Room 191

Coherence properties of light scattered from a random surface.

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We show that the spatial correlation of an optical field scattered from a randomly rough metal surface depends on the distance from the surface. Specifically, we study the scattering of p-polarized monochromatic light incident from vacuum on a one-dimensional randomly rough metal surface. The surface profile function is assumed to be a single-valued function of the coordinate perpendicular to its generators in the mean plane of the surface. It is also assumed to be differentiable and constitutes a stationary, zero-mean, Gaussian random process. We calculate the spatial magnetic field amplitude-amplitude correlation function in a plane parallel to the mean surface as a function of the distance of this plane from the surface. The vacuum-metal interface supports surface plasmon polaritons, and the angular dependence of the intensity of the light scattered diffusely displays the enhanced backscattering effect. The correlation function is calculated from the solution of a Bethe-Salpeter equation. It can be written as the sum of a contribution that is independent of the distance from the surface and a contribution that is a function of this distance and decays as this distance increases. The decay length of the latter contribution is determined.

1:40pm, Friday, Nov. 14

Bldg 50 Auditorium

Kaluza-Klein Modes of the 4d N=4 Supersymmetric Yang-Mills Theory on 3-Sphere and Strong Theory and Matrix Theories in 10d and 11d Plane-Wave Spacetimes

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The duality of gauge theory and gravity is a big mystery in the universe. I will describe here an example of such duality, initiated by Maldacena, etc. The 4d N=4 Super-Yang-Mills action is dimensionally reduced to 1d on a 3-sphere. The Kaluza-Klein modes of the 4d fields are truncated and only few of them are selected by the BPS condition. The resulting 1d theories become 10d or 11d matrix theories of strings in plane-wave spacetime backgrounds, which are Penrose limits of various AdS*S spacetimes. I will also briefly discuss the validity of this conjecture in different interacting regimes, the symmetry breaking processes, and the dynamic reasons of such duality.

Bldg 70 Room 191

Light Scattering From a Circularly Symmetric Surface Defect and the Excitation of Surface Polaritons

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In a previous investigation [SPIE 4447, 24-33 (2001)] we have studied the excitation of a surface plasmon polariton (SPP) when a volume electromagnetic wave in the form of a beam illuminates a circularly symmetric protuberance or indentation of Gaussian form on an otherwise planar metal surface in contact with vacuum. The fraction of the incident flux that was scattered into a SPP was rather small, of the order of one percent. In this paper, we propose a different form for a circularly symmetric surface defect and show that it is possible to achieve a much higher efficiency for the excitation of a SPP. The surface profile function we employ is of cosinusoidal form along the radial coordinate up to a cut-off radius, and vanishes outside this radius. By exploiting the circular symmetry of the problem we expand the reduced Rayleigh equation for the p- and s-polarized components of the electromagnetic field above and on a vacuum-metal interface into a set of one-dimensional integral equations that we then solve numerically. The solution of the integral equations in the first Born approximation shows that the scattering amplitude is related to the Bragg vector of the periodic part of the surface. Thus, a specific scattering geometry can be optimized by adjusting the periodicity and (...)

2:00pm, Friday, Nov. 14

Bldg 50 Auditorium

Quantum Liouville theory and BTZ black hole entropy

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I will give an explicit conformal field theory description of (2+1)-dimensional BTZ black hole entropy. In the boundary Liouville field theory I investigate the reducible Verma modules in the elliptic sector, which correspond to certain irreducible representations of the quantum algebra $U_q(sl_2) \odot U_{\hat{q}}(sl_2)$. I will show that there are states that decouple from these reducible Verma modules in a similar fashion to the decoupling of null states in minimal models. Because of the non-standard form of the Ward identity for the two-point correlation functions in quantum Liouville field theory, these decoupling states have positive-definite norms. The explicit counting from these states gives the desired Bekenstein-Hawking entropy in the semi-classical limit when q is a root of unity of odd order.

Bldg 70 Room 191

The Scattering of Light from a Randomly Rough Dielectric Film on a Reflecting Substrate

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Coherent light scattered from a randomly rough surface of a dielectric film, deposited on the planar surface of a reflecting substrate consists of fringes whose angular positions (intensity maxima) are either independent of the angle of incidence (Selenyi fringes) or move with a change of the angle of incidence (Quetelet fringes), depending on the strength of the surface roughness. Despite a long history of studies of these fringes, including rigorous computer simulation studies, some controversy still remains in qualitative and quantitative descriptions of their origin and behaviour. In this paper we study analytically and by means of rigorous numerical simulations interference effects in the scattering of light from a dielectric film deposited on the planar surface of a metallic substrate. The illuminated surface of the film is a one-dimensional randomly rough surface, and the plane of incidence is perpendicular to the generators of the surface. The surface profile function is a sum of two profile functions, one of which describes a short-scale roughness of the surface, and the other a long-scale roughness of the surface. Each of the profile functions is single-valued function that is differentiable as many times as is necessary, and constitutes a zero-mean, stationary, uncorrelated, Gaussian random process. (...)